Arctic expedition in the *Willem Barents*. He edited for the Hakluyt Society an account of the three voyages of William Barents. A daily contemporary confounded Lieut. Beynen with the well-known Arctic explorer, Lieut. Payer, who, we are glad to say, is alive and as well as ever.

RECENT advices from Japan state that the port of Gensan in Corea has been opened to Japanese traders. The Japanese, however, appear to have been more anxious to obtain the opening of Nikawa, a more important place, and about nineteen miles from the capital, Hányang (Séoul). The Coreans refused to concede this point, probably on account of a sacred character attaching to the road which separates the two.

## *BIOLOGICAL NOTES*

OOSPORES OF "VOLVOX MINOR."—Dr. Kirchner, in the recent part of Cohn's "Beiträge zur Biologie der Pflanzen," describes the germination of the oospores, and in this supplements the important contribution made by Cohn himself to our knowledge of this interesting plant in the first volume of the same work. The first appearance of germination was in February. The contents of the oospores during a rapid swelling out of the endospore, made their appearance through the ruptured exospore, and soon presented a sphere-shaped body, which then divided into two portions, these being perpendicular to one another. The newly-formed cells so separate from one another that they hang together by their ends. These ends form the one pole of the later-to-be-developed ball-like colony; the other pole is afterwards closed in, when the maximum of the cells is attained. Each oospore thus gives rise through cell division, followed by the characteristic cell displacement, to a new volvox colony. The fact of *V. minor* being diœcious was given as a character to distinguish it from *V. globator*, but this, according to the author, does not hold true; both colonies seem to pass through a purely female stage and afterwards through a male stage, each colony being bi-sexual.

CEDAR OF LEBANON IN CYPRUS.—Sir Samuel Baker, in his late residence in this island, has been fortunate in bringing to light the existence of this tree, or a variety of it, according to Sir J. D. Hooker. It seems the monks of Trooditissa Monastery assured the former that the "chittim-wood" of Scripture, a kind of pine, grew in the mountains near Krysokus. Trusty messengers having been despatched in search thereof, they brought back specimens of a cedar, with dense foliage and a superior quality of wood. Sir J. Hooker, to whom the specimens were forwarded, after a careful examination, finds that this tree differs from the true cedar of Lebanon in having shorter leaves and smaller female cones, with other slight differentiations. He names it, therefore, *Cedrus libani*, var. *brevifolia*, a short botanical account of which, along with Sir Samuel's letter, he laid before the Linnean Society at their last meeting. In his letter Sir S. Baker further hints that a variety of cypress some thirty feet high and seven feet girth, with a cedar-coloured wood, and powerfully aromatic scent of sandal-wood, in his opinion, is the celebrated "chittim-wood." He asks: "Why should Solomon have sent for cedar, which is so common in Asia Minor?" Another hard-wooded cypress, of twenty feet high, yields an intensely hard wood resembling *Lignum vitæ*.

NEW GENUS OF MYRIAPOD.—In the October number of the *American Naturalist* Mr. J. A. Ryder describes and figures a new genus allied to the little myriapod described some years since by Sir John Lubbock as Pauropus. This new American form is found in moist situations under sticks and decaying vegetable matter. It is called *Eurypauropus spinosus*, receiving its generic name in reference to its great relative width. The body is composed of six segments, possibly of seven. The head is partly free, the surface of the head and other segments is covered with small tubercles or spines. Two pairs of legs are attached to each of the second, third, fourth, and fifth segments, which, with a single pair on the first segment, makes nine pair in all. The legs are completely concealed in life by the lateral expansions of the body segments. The oral region seems to be very similar to that in Pauropus. There is no evidence of tracheal openings. Eyes seem to be absent. The antennæ are five-jointed, inserted close together at the front of the head, and are branched. The outer branch bears two of the many-jointed filaments, between the bases of which arises a pedicel surmounted by an ovoid semi-transparent body with linear sepal-like processes clasping it much as in *Pauropus pedunculatus*. The length is one-twentieth of an inch, and the habitat Fairmount Park, Eastern Penna.

ZOSTERA MARINA.—A. Engler, in a recent number of the *Botanische Zeitung* (October 10), has published some interesting observations on the fertilisation and growth of the sea grass growing at Kiel. He pronounces Hofmeister's observations on the fertilisation of Zostera as incorrect, but corroborates those of Clavaud (published in the *Botanische Zeitung* for August). At first it is true that the thread-like stigma lies on the neighbouring anther lobes, mostly those of two different anthers; next the style elevates itself, and so the stigma comes out of the narrow slit in the sheath, and receives the pollen given out by some of the older spadices. After fertilisation, the thread-like stigmas disappear, and at the same moment will be found clusters of as yet unopened anthers around the stigmaless gynœcia, these now having fertilised ovules. This was probably the stage observed by Hofmeister when he described the fertilisation as taking place inside the unopened inflorescence. Certainly the anther-lobes are not at this stage always emptied of their contents, and certainly when this emptying takes place the gynœcia are often beyond the power of being fertilised. The conditions of the buds in Zostera also specially engaged Engler's attention, because the sympodial bud system appeared similar to that in many of Araceæ. The main shoot which roots in the mud develops out of the angle of the nodal scale like lower leaves, which, however, soon die off, sterile buds, and then after the formation of four to six internodes in the ground, grows upwards, now developing leaves often a metre long, but never in the same year is the inflorescence observed. The sterile sprouts are found to the right and to the left of the main shoot; the upper internodes of this latter elongate and erect themselves, but now in the angles of the lower leaves are only ferfile buds developed, which lie alternately right and left of the main axis. The first fertile bud is generally quite free, and carries three to four club-shaped bodies sympodially arranged as described by Eichler. The following fertile buds grow for a great while along with the main axis, the axis of growth thus presenting a flattened cone-shaped form with two furrows superimposed on a cylindrical axis. As to the inflorescence, Engler suggests that it is not impossible, but that the Gynœcia and Andrœcia may each represent separate flowers so arranged that male and female flowers of the simplest type should stand opposite to one another. This, though opposed to the views of Ascherson and Eichler, seems to have some support from the fact that in the case of Spathicarpa ("Flora Brasiliensis," pl. 51), one of the Araceæ, this position of the male and female flowers occurs; only in this case, there can be no doubt of the fact, as there seems of necessity to be in Zostera, for the Andrœcia and Gynœcia are in Spathicarpa formed of several sexual leaves.

THE ONTOGENY AND PHYLOGENY OF THE CTENOPHORA.—Prof. Haeckel, in a recent number of *Cosmos* (vol. iii. Part 5, August, 1879), describes a new form which he calls *Ctenaria ctenophora*, as a connecting-link between the Ctenophora and the Medusæ. This species is figured, but fuller details are promised in the author's "System of the Medusæ," which, illustrated with forty plates, is nearly ready for publication. The new form is placed as a craspedote in the order of the Anthomedusæ, and in the family of the Cladonemidæ. Accompanying a brief description, there is an interesting paragraph on the "Ontogeny and Phylogeny of the Ctenophores." It would seem highly probable that the Ctenophores are descended from the Cladonemidæ, and that their still earlier ancestors were Hydrozoa allied to Tubularia. Among the newer adaptations, by means of which the Medusæ form of the younger Ctenophore originated, the most important is undoubtedly the change in the method of locomotion. The Medusæ swim in a spasmodic manner by irregularly contracting their umbrellæ, and then driving the water out of the cavity. The easy gliding, swimming movement of the Ctenophoræ is brought about by the vibrations of the little oar-blades which cross over the surface of the eight radial ciliated combs. While this newer form of motion took the place of the former, a number of other changes were immediately brought about according to the laws regulating the correlation of organs. The more important morphological relations were nevertheless, through the conservative power of inheritance, preserved. This interesting form possesses the eight ad-radial thread-cell channels as in Ectopleura, the trichter as in Eleutheria, the oral formation as in Cytæis, the canal-formation as in Cladonema, and the tentacles and tentacular pockets as in Gemmaria; transitory between two classes, it furnishes a new convincing proof of the verity of the doctrines of development.

ARSENIC IN ANIMALS.—Prof. Ludwig has recently (*Wiener Akad. Anz.*) inquired into the distribution of arsenic in the animal organism after ingestion of arsenious acid. The objects he examined were the organs of suicides who had poisoned themselves with arsenic, and of dogs which were poisoned, some acutely, some chronically, with arsenic. In all experiments it was found that the arsenic accumulated most in the liver, and that in acute poisoning the kidneys also contained abundant arsenic, whereas in the bones and in the brain there was little of the poison. In case of chronic poisoning with arsenic, where death did not ensue, the poison was found to remain (after ingestion was stopped) longest in the liver, being much sooner excreted from the other organs. The results of this investigation are in direct opposition to those obtained by Scolosuboff, who always found most arsenic in the brain.

DIOPTRICS OF THE EYE.—In the investigation of the dioptric properties of the crystalline lens of the eye, physiologists have hitherto accepted an index of refraction of the lens determined for only one condition of accommodation. It seemed desirable to Herr Matthiessen to attain greater accuracy by ascertaining the dioptric properties of the lens in different states of accommodation, the structure of the lens as now known being fully considered. The subject is discussed at length by him in *Pflüger's Archiv* (xix. p. 480). In tabular form he presents a comparison of the positions of the dioptric cardinal points for the human eye and for the eyes of several lower animals, corresponding to different states of accommodation, infinite distance 160 mm. and 100 mm. A comprehensive list of works on the dioptrics of the lens and the eye generally is added to Herr Matthiessen's paper.

## EXPERIMENTAL DETERMINATION OF THE VELOCITY OF LIGHT[1]

LET S, Fig 1, be a slit through which light passes, falling on R, a mirror free to rotate about an axis at right angles to the plane of the paper; L, a lens of great focal length, upon which the light falls, which is reflected from R. Let M be a plane mirror, whose surface is perpendicular to the line R M, passing through the centres of R, L, and M, respectively. If L be so placed that an image of S is formed on the surface of M, then, this image acting as the object, its image will be formed at S, and will coincide point for point with S.

If, now, R be turned about the axis, so long as the light falls on the lens, an image of the slit will still be formed on the surface of the mirror, though on a different part, and as long as the returning light falls on the lens, an image of this image will be formed at S, notwithstanding the change of position of the first image at M. This result, namely, the production of a stationary image of an image in motion, is absolutely necessary in this method of experiment. It was first accomplished by Foucault, and in a manner differing apparently but little from the foregoing.

In this case, L, Fig. 2, served simply to form the image of S, at M; and M, the returning mirror, was spherical, the centre coinciding with the axis of R. The lens, L, was placed as near as possible to R. The light forming the return image lasts, in this case, while the first image is sweeping over the face of the mirror, M. Hence the greater the distance, R M, the larger must be the mirror, in order that the same quantity of light may be preserved, and its dimensions would soon become inordinate. The difficulty was partly met by Foucault, by using five concave reflectors instead of one; but even then the greatest distance he found it practicable to use was only twenty meters.

Returning to Fig. 1, suppose that R is in the principal focus of the lens, L; then if the plane mirror, M, have the same diameter as the lens, the first or moving image will remain upon M as long as the axis of the pencil of light remains on the lens, and *this will be the case no matter what the distance may be.*

When the rotation of the mirror, R, becomes sufficiently rapid, then the flashes of light which produce the second or stationary image become blended, so that the image appears to be continuous. But now it no longer coincides with the slit, but is deflected in the direction of the rotation, and through twice the angular distance described by the mirror, during the time required for light to travel twice the distance between the mirrors. The displacement is measured by its arc, or, rather, by its tangent. To make this as large as possible, the distance between the mirrors, the radius, or distance from the revolving mirror to the slit, and the speed of rotation should be made as great as possible.

The second condition conflicts with the first, for the "radius" is the difference between the distances of principal focus and the conjugate focus for the distant mirror. The greater the "distance," therefore, the smaller will be the "radius." There

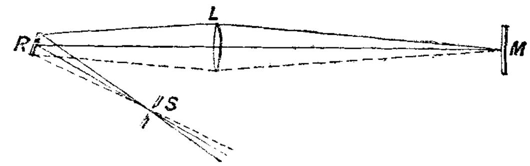


FIG. 1.

are two ways of solving the difficulty: first, by using a lens of great focal length, and, secondly, by placing the revolving mirror within the principal focus of the lens. Both means were employed. The focal length of the lens was 150 feet, and the mirror was placed about fifteen feet within the principal focus. A limit is soon reached, however, for the quantity of light received diminishes very rapidly as the revolving mirror approaches the lens.

The chief objection urged in reference to the experiments made by Foucault is that the deflection was too small to be measured with the required degree of accuracy. This de-

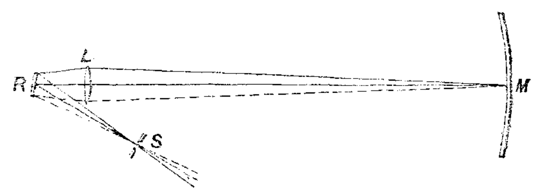


FIG. 2.

flection was but a fraction of a millimeter, and when it is added that the image is always more or less indistinct on account of atmospheric disturbances, as well as imperfections of lenses and mirrors, it may well be questioned whether the results could be relied upon within less than one per cent.

In the following experiments the distance between the mirrors was nearly 2,000 feet. The radius was about thirty feet, and the speed of the mirror was about 256 revolutions per second. The deflection exceeded 133 millimetres, being about 200 times that obtained by Foucault. If it were necessary it could be

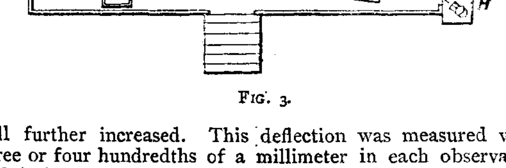


FIG. 3.

still further increased. This deflection was measured within three or four hundredths of a millimeter in each observation; and it is safe to say that the result, so far as it is affected by this measurement, is correct to within one ten-thousandth part.

The site selected for the experiments was a clear, almost level stretch along the north sea-wall of the Naval Academy. A frame building was erected at the western end of the line, a plan of which is represented in Fig. 3.

The building was forty-five feet long and fourteen feet wide, and raised so that the line of light was about eleven feet above

[1] By Albert A. Michelson, Master, U.S. Navy Read before the American Association.